REMARKS/ARGUMENTS

Reconsideration and allowance of this application are respectfully requested. Currently, claims 1-11 and 13-24 are pending in this application.

Objections to the Claims:

Claims 5, 6 and 19 were objected to because of informalities. By this Amendment, claims 5, 6 and 19 have been editorially amended to overcome these objections. In particular, claim 19 has been amended by incorporating the contents of claim 14. Applicant therefore requests that the objections to the claims be withdrawn.

Rejection under 35 U.S.C. §101:

Claims 1-11 were rejected under 35 U.S.C. §101 as allegedly being directed to non-statutory subject matter. Applicant traverses this rejection.

In particular, section 9 (pg. 6) of the Office alleges that "The specification at page 11, line 33 – page 12, line 4 indicates that the invention can be implemented in software. Since the software is not embodied in a computer readable medium, the invention is directed towards non-statutory subject matter...." Applicant disagrees with this allegation.

First, the allegation that "invention can be implemented in software" ignores the context provided by the specification. For example, the full context provided by the specification beginning at page 11, line 33 discloses that the "...embodiment of the invention is implemented in software *on a computer system* (emphasis added)." Correspondingly, claim 1 explicitly requires "using one or more computer processing systems" and is therefore "tied" to a machine (i.e., tied to another statutory category specifically enumerated by 35 U.S.C. §101). Claim 1 is thus directed to statutory subject matter.

Second, the allegation that "Since the software is not embodied in a computer readable medium..." is incorrect as evident from the explicit teachings relating to the "computer readable storage medium" provided by page 10, line 14 *et seq.* of the original specification and as well as from original claim 13 which forms part of the original specification.

Rejection under 35 U.S.C. §102 and 103:

Claims 1-4 and 12-17 were rejected under 35 U.S.C. §102 as allegedly being anticipated by Subramaniyan et al. (U.S. '134 hereinafter "Subramaniyan"). Applicant traverses this rejection.

Anticipation under Section 102 of the Patent Act requires that a prior art reference disclose every claim element of the claimed invention. See, e.g., *Orthokinetics, Inc. v. Safety Travel Chairs, Inc.*, 806 F.2d 1565, 1574 (Fed. Cir. 1986). Subramaniyan fails to disclose every claim element of the claimed invention. For example, Subramaniyan fails to disclose "a) determining, using one or more computer processing systems, a motion estimation representative of the global motion between the particular frame and a first preceding or succeeding frame of the inter-frame encoded video sequence, on the basis of motion vectors directly between the particular frame and the first preceding or succeeding frame; b) determining, using the one or more computer processing systems, one or more further motion estimations representative of the global motion between the particular frame and the first preceding or succeeding frame at least partially on the basis of motion vectors between the particular frame and one or more preceding or succeeding other frames; and c) selecting, using the one or more computer processing systems, one of the motion estimations which meets at least one predetermined criterion as being representative of the global motion of the particular frame," as required by independent claim 1 and its dependents. Similar comments apply to the remaining independent claims.

The invention of claim 1 applies to a current frame (referred to as *"a particular frame"* in claim 1) and another frame (referred to as *"a first preceding or succeeding frame"* claim 1). The invention of claim 1 involves finding parameters describing the global motion as between the first preceding or succeeding frame and the particular frame. Advantageously, the invention of claim 1 provides an improvement in generating a global motion estimation between two frames of a video sequence that is more resilient to the presence of noise in the encoded video signal by virtue of calculating motion estimations along alternative routes from a reference frame to the particular frame in question.

In part (a) of claim 1, a global motion estimation is initially determined directly between the two frames. In part (b) of claim 1, a global motion estimation is determined describing the global motion between the two frames using motion information associated with other preceding or succeeding frames. In part (c) of claim 1, the separate estimates are combined to arrive at single estimate of global motion between the different frames. These features are supported by, for example, page 21, lines 12-18 of the original specification (inserted language provided in brackets):

> *"(i) from P4 [i.e., the particular frame] compute a global motion estimation back to the anchor frame I1 [i.e., the first preceding or succeeding frame] directly via the forward motion vectors contained in P4; (ii) from P4 use the backward motion vectors in frame B3 [i.e., one of the preceding or succeeding other frames] between P4 and B3 to obtain a global motion estimation between P4 and B3, and then use the forward motion vectors in B3 to obtain a global motion estimation between B3 and I1. The two estimations can then be accumulated to give overall global motion estimation between P4 and I1".*

Subramaniyan fails to disclose features (a)-(c) of claim 1. Subramaniyan works in a different way to achieve a different result. Subramaniyan describes three frames, for example,

(e.g., call them A, B and C) and uses a set of known vectors between two earlier frames (e.g., A to B) to estimate vectors (by generating predictor motion vectors (PMV)) for coding from one of these frames to the current frame (e.g., from B to C). It follows that the objective of Subramaniyan is to encode frame C relative to frame B. That is, to find individual vectors encoding each block of pixels (macroblock) from frame B and to use the found vectors as predictor motion vectors to direct a search for to the best-match macroblock from frame C. See paragraph [0013] which states the following:

> *"[a] method and apparatus for determining the quality of a block match for a candidate motion vector in a video encoder system using motion vectors representing the difference in coordinates of a macroblock of data in a current frame of video data and coordinates of a related macroblock of data in a reference frame of video data".*

The significant part of Subramaniyan lies in the use of predictor motion vectors (i.e., the individual macroblock motion vectors used to encode a previous frame) to direct searches for the best individual macroblock motion vectors to encode the current frame.

The invention of claim 1 is different from the use of the predictor motion vectors of Subramaniyan. For example, the invention of claim 1 does not involve regenerating individual macroblock motion vectors between the present frame and a previous frame. There is no need to do so, as these individual macroblock motion vectors already exist in the encoded video signal to which the invention of claim 1 is applied.

Instead, the invention of claim 1 uses the individual macroblock motion vectors already existing in the encod***ed*** current frame in order to generate a single vector characterizing global motion between the encoded current frame and an encoded previous frame. Advantageously, the single vector characterizing global motion is derived from a combination of two independently calculated global motion values.

Subramaniyan uses predictor motion vectors to match pixel blocks (macroblocks) in preparation for encoding an image. The encoding comprises the generation of a plurality of vectors, each representing motion of a different sub-part of the image when compared to the equivalent sub-part of a previous image in the sequence. In the invention of claim 1, motion estimation is applied to an already encod***ed*** image in order to allow the plurality of vectors to be replaced by a single vector, e.g. for the purposes of image registration. Subramaniyan is directed to assessing, in a video encoder system, the quality of matching blocks in one frame with blocks in another frame (see the Summary of Invention of Subramaniyan at paragraph [0013]).

From the abstract, Subramaniyan is directed to a video encoder system (i.e., a system for taking raw, unencoded pixel data and producing an encoded sequence of video frames). This understanding of Subramaniyan is confirmed when reading the Background to the Invention section of Subramaniyan. For example paragraph [0004] of Subramaniyan discloses (emphasis added):

> *"[t]he purpose of motion estimation is to reduce temporal redundancy between frames of a video sequence. .... A difference image is computed by taking the arithmetic difference between the original pixel data and the corresponding predicted pixel data".*

Subramaniyan thus describes processing raw pixel data in an unencoded frame with the obvious intent of encoding the frame in the video encoder. As such, Subramaniyan could be seen as a precursor stage to the method of the invention of claim 1, in that Subramaniyan describes generating an encoded signal of the type that is processed by the present invention. However, since Subramaniyan could be seen as a precursor stage to the method of the invention of claim 1, Subramaniyan clearly fails to disclose features (a)-(c) of claim 1. The invention of claim 1 deals with a video signal that is already encod***ed***, as stated by the claim 1.

As indicated at paragraph [0030], one option for the predictor motion vectors used in Subramaniyan is an estimate of global motion for a previous frame (i.e., not for the current frame, as in the invention of claim 1). Subramaniyan describes at paragraph [0035] looking at the individual macroblock motion vectors between two earlier frames, eliminating some of the vectors to get what is described as a "global motion vector." Subramaniyan then uses this previous frame global motion vector as the starting point for performing a motion search for the current frame.

As with the other predictor motion vectors, the estimated global motion vector is not used to represent global motion of the current frame, but to indicate where in the current frame to start a search for the best individual macroblock motion vectors with which to encode the current frame. Subramaniyan therefore discloses use of a global motion vector relating to a frame occurring earlier in the sequence to the current frame. This is far removed from the invention of estimating global motion of the current frame – as required by claim 1. Indeed, Applicant submit that this as diametrically opposite, given that Subramaniyan teaches a method of encoding whilst the present invention provides for estimating global motion in a already encod***ed*** image sequence.

Advantageously, the invention of claim 1 provides an improvement on known techniques by generating from encoded motion vectors, a global motion estimation between each frame of an encoded video sequence while addressing problems related to noise present in the encoded motion vectors. This is achieved according to the invention of claim 1 by calculating motion estimations along different routes from a reference frame to the particular frame in question. Individual global motion estimations are made between each pair of frames on the alternative

route, and these estimations are then accumulated to give a more reliable estimation of overall motion.

Estimation of global motion using macroblock motion vectors present within encoded video is an important tool in image registration. However, noise present in motion vector information can lead to erroneous results. Claims 1 and 14 provide a method and system not found in the prior art which reduce the impact of such noise by calculating motion estimations along two different routes from the anchor frame to the frame in question.

Claims 6-9 were rejected under 35 U.S.C. §102 as allegedly being anticipated by Jinzenji (U.S. '664, hereinafter "Jinzenji"). Claims 5 and 18 were rejected under 35 U.S.C. §103 as allegedly being unpatentable over Subramaniyan in view of Lee et al. (U.S. '568, hereinafter "Lee"). Claims 10-11 were rejected under 35 U.S.C. §103 as allegedly being unpatentable over Jinzenji in view of Szeliski et al. (U.S. '918, hereinafter "Szeliski"). Claims 19-22 were rejected under 35 U.S.C. §103 as allegedly being unpatentable over Subramaniyan in view of Jinzenji. Claims 23-24 were rejected under 35 U.S.C. §103 as allegedly being unpatentable over Subramaniyan in view of Jinzenji, and further in view of Szeliski. Each of these claims depends either directly or indirectly from base independent claim 1, 14 or 19. None of the above-noted additional references (Jinzenji, Lee and/or Szeliski) resolves the above-described deficiencies with respect to Subramaniyan. Applicant therefore respectfully requests that each of these rejections under 35 U.S.C. §102 or §103 be withdrawn.

Conclusion:

Applicant believes that this entire application is in condition for allowance and respectfully requests a notice to this effect. If the Examiner has any questions or believes that an

interview would further prosecution of this application, the Examiner is invited to telephone the undersigned.

Respectfully submitted,

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